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Canada Centre for Mineral and Energy Technology
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COMPUTER AIDED RAPID DETERMINATION OF THE EXPLOSIBILITY OF MINE FIRE GASES

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COMPUTER AIDED RAPID DETERMINATION OF THE EXPLOSIBILITY OF MINE FIRE GASES

by

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ABSTRACT

There is an obvious need for systematic and accurate records of the mine atmosphere composition during an emergency created by an underground fire or heating.

Fast and precise information on the explosibility limits and on any trends and changes in the fire gases composition is essential for the efficient planning and modification of the fire fighting strategy.

The computer program rapidly calculates and plots the explosibility diagram (Coward's Triangle) for the entered results of the fire atmosphere analysis.

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LA DETERMINATION RAPIDE ASSISTEE PAR ORDINATEUR DE L'EXPLOSIBILITE DES GAZ DEGAGES PENDANT LES INCENDIES DANS LES MINES

par

W.G. Klinowski*

RESUME

Il existe un besoin évident de relevés systématiques et précis de la composition de l'atmosphère dans une mine pendant une urgence créée par la chaleur ou un incendie souterrains.

Il est essentiel d'avoir des renseignements rapides et précis sur les limites d'explosibilité et sur les tendances et les changements de la composition des daz dégagés pendant un incendie afin de planifier et de modifier efficacement les stratégies de lutte contre l'incendie.

Le programme d'ordinateur calcule et trace rapidement le diagramme d'explosibilité (Triangle de Coward) pour les résultats de l'analyse de l'atmosphère créée par un incendie qui ont été entrés.

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INTRODUCTION

There is an obvious need for systematic and accurate records of the mine atmosphere composition during an emergency created by an underground fire or heating.

Fast and precise information on the explosibility limits and on any trends and changes in the fire gases composition is essential for the efficient planning and modification of the fire fighting strategy.

The computer program, described below, rapidly calculates and plots the explosibility diagram (Coward's Triangle) for the entered results of the fire atmosphere analysis. Simultaneous plotting of several samples (to detect and visualize any pronounced trends and changes in their compositions) is also possible.

The computer processed information can be stored in the magnetic memory and retrieved and plotted in any combination when needed.

PROGRAM DESCRIPTION

This program was written in BASIC for the IBM-AT personal computer and HP plotter.

The method used for the calculation of the explosibility triangle coordinates was originally published by Hughes and Raybould (1). This method has been chosen because of its simplicity and adequate accuracy, but any other method can be used by the relatively easy alteration of the calculation module of the program.

According to the authors, Hughes and Raybould claim; "... the method has been extensively tested on a number of mine fire gases and has been found to give close agreement with the results obtained by the classical method of Coward and Jones ...". Further; "... to simplify the calculations, carbon dioxide is equated with nitrogen; since carbon dioxide has a greater extinctive effect on combustibles than nitrogen, the method always errs on the safe side, the magnitude of the safety margin depending on the proportion of carbon dioxide in the mine fire atmosphere".

PROGRAM OPERATION

The program offers several choices in the displayed menu:

- Coward Triangle for the previously recorded sample.
- Limit diagram (Coward Triangle) for a new sample.
- Composite limit diagrams for several samples.
- Review of the contents of the storage file.
- Hardcopy of the contents of the storage file.

Following the users selection, the program performs particular routines, described below:

1) Limit diagram for a new sample

Answering the series of prompts from the screen, the user enters sample identification strings (sample's number, time, date and location) and the results of the sample composition analysis (% of total volume of N_2, O_2, CO_2, CO, CH_4, H_2, C_2H_6). The explosibility diagram for the entered sample is then plotted by HP plotter (Figure 1). The results can be optionally stored in the magnetic file and the user is returned to the menu level.

2) Coward Triangle for the previously recorded sample

The user is presented on the screen with the contents of the storage file. After chosing and entering the sample number, the explosibility diagram is plotted (Figure 1) and the menu displayed again.

3) Composite limit diagrams for several samples

The user is presented on the screen with the contents of the storage file. After deciding on the number of samples to be plotted (number limited by the selection of pen colours) and entering the identification numbers of the chosen samples, the user is presented with the composite diagram as in Figure 2.

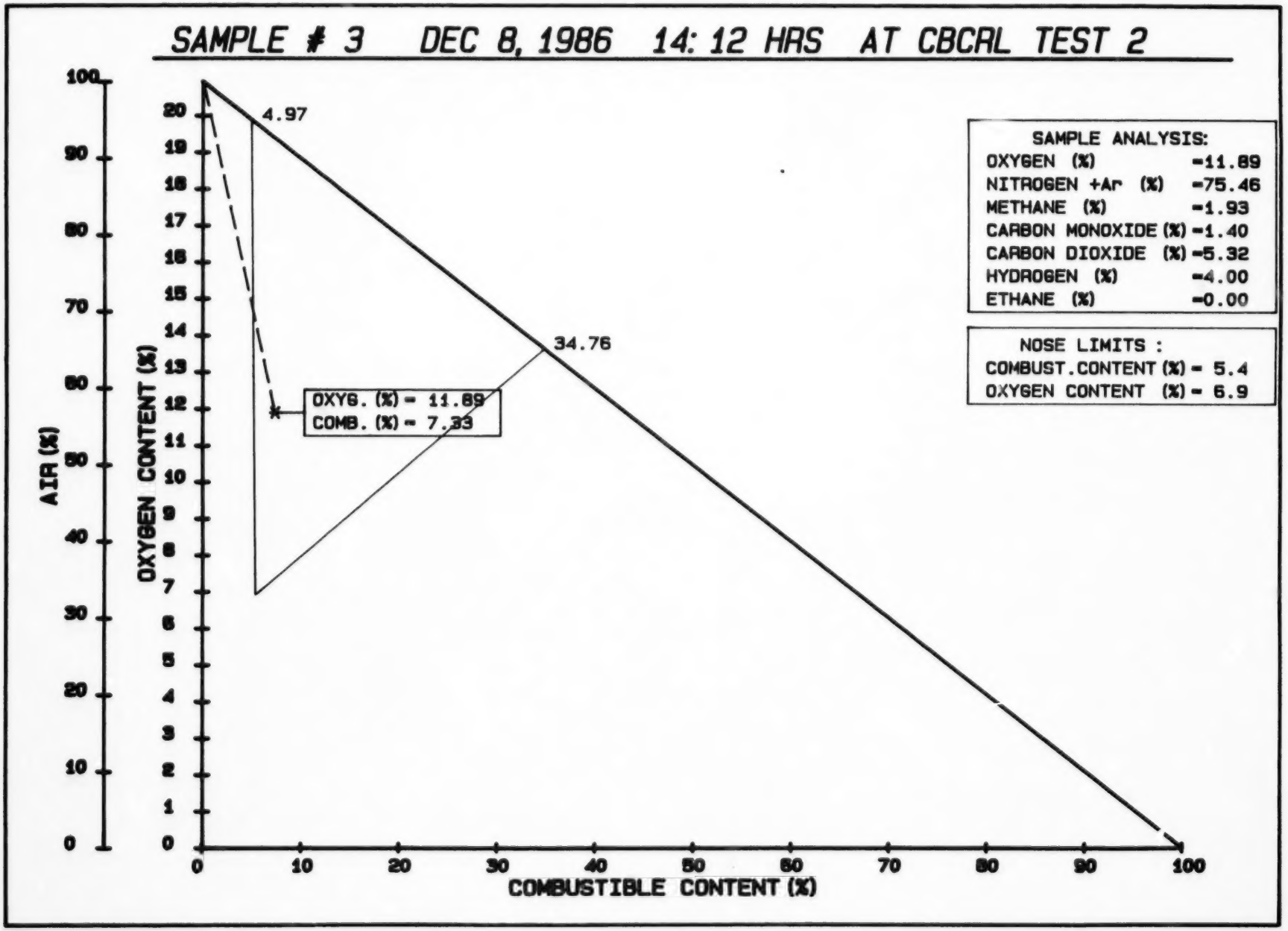

Figure 1 - Limit diagram

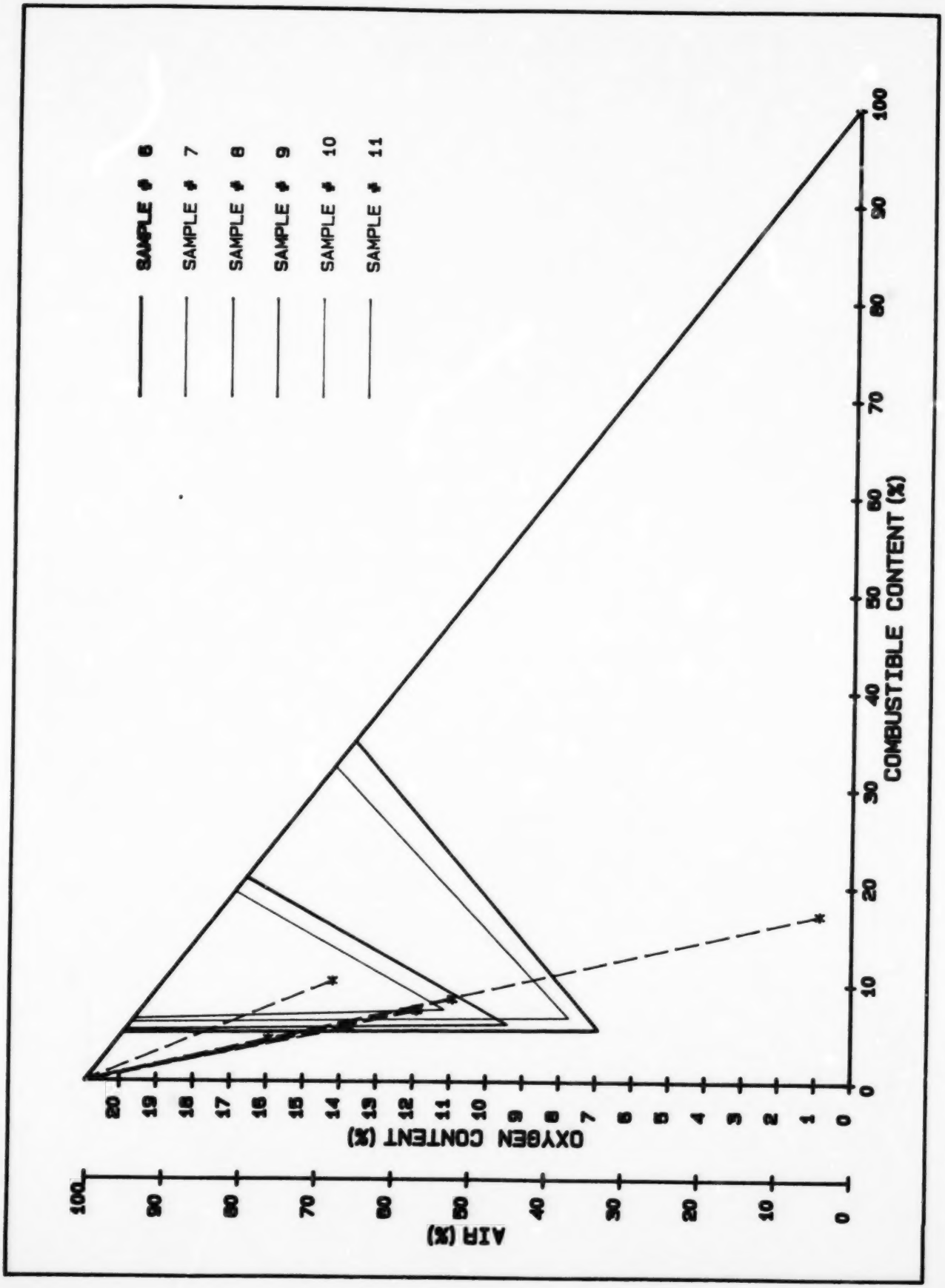

Figure 2 - Composite diagram

REFERENCES

1. Hughes, A.J. and Raybould, W.E. "The rapid determination of the explosibility of mine fire gases"; The Mining Engineer; No. 1; October 1960.